

**Development of an X-Ray Computed Tomography
System for Advanced NDE of Spacecraft
Components**

323-78

Level 2A Plan

Approval:

NDE Program Manager

Concurrence:

Code QT Division Director

Title: Development of an X-Ray Computed Tomography System for Advanced NDE of Spacecraft Components

AWCS# 323 - 78

I. Objective

An X-Ray Computed Tomography (CT) system is to be developed at the NASA White Sands Test Facility providing a capability to more completely examine the interior of spacecraft components in both assembly operations and diagnostic investigations of failed components.

II. Center Point of Contact

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III. Technical Methodology/Approach

Background

Film x-ray has been used at WSTF for the examination of spacecraft components since the mid-1960's. This is done in support of our component and engine testing programs onsite and in diagnostic investigations performed for NASA or outside customers. These components vary in both size and complexity and often the information sought is not well defined and suspected flaws or anomalies are difficult to locate.

During a recent study of NDE techniques to inspect O-ring seals in pyrovalves, the use of both N-Ray and X-Ray computed tomography (CT) gave amazingly good quality and useful images of O-ring damage that could be viewed from a variety of positions through computer postprocessing. It also became apparent that the commercially available systems used for these surveys represented an improved state-of-the art from those CT systems developed in the late-1980's.

It was determined that an X-Ray CT system would significantly enhance the capabilities at WSTF to evaluate spacecraft components during component assembly operations and diagnostic investigations of failed components. Available site funds were directed towards evaluating system architecture options and developing a functional X-Ray CT system.

Current X-Ray System Description and Capabilities

A commercial manipulator and controller system, along with a computer data acquisition system for digital radiography (DR) was purchased from Hytec Corporation for use with the following existing equipment:

- Dual-focus, constant potential, 160 KV x-ray source
- Fast, 9-inch scintillator with image intensifier
- Medium resolution digital camera with interface.

The manipulator was sized to accommodate an OMS engine chamber, with a swing of 18 in. and a weight of 150 lb. Other system components scheduled for procurement in the near future are:

- Fixturing in the X-ray Laboratory for the detector and source mount
- A Scientific-grade, Hi-Resolution digital camera to provide the highest-quality laboratory-grade digital data for post processing.

This equipment is being assembled in FY2001 to provide a first capability to provide digital X-ray results to WSTF customers.

Planned Improvements and Conversion to Computed Tomography System

The remaining equipment to be purchased that would provide a wide range of both DR and CT capabilities are:

- A Large Scintillator detector assembly to be constructed by DOE Savannah River at cost to provide for capture of a larger image
- A Digital Array for use in production-type applications where fixed resolution is not a limitation
- Reconstruction software for X-Ray CT enhancement that is available from DOE at no cost to NASA.

Implementation and checkout of this system will be provided by WSTF as part of the annual operating costs of providing NDE services to WSTF customers.

IV. Customers

The system will be used to provide NDE services for customers within WSTF such as Depot, where shuttle components are refurbished, and external to WSTF. External customers include other NASA sites, NASA contractors, and other government agencies.

V. Metrics

Over the two-year project life, quarterly reviews will be provided to the customer. Project reviews will cover system development and its' application.

VI. Products

The final product would be a state-of-the-art X-ray CT system for examining spacecraft components of varying size and complexity within the limit of the 150-lb load capacity of the sample support and manipulator.

VII. Schedules/Milestones

FY02

First Quarter:	Release Purchase Order for Large-scintillator detector system
Second & Third Quarter:	Receive Large-scintillator system and complete X-ray DR system; receive Reconstruction software and demonstrate CT operation
Fourth Quarter:	Document system performance and develop operational guidelines manual

FY03

First Quarter:	Release Purchase Order for Digital Array
Second & Third Quarter:	Receive array and demonstrate system performance with this component
Fourth Quarter:	Prepare summary report for NDE Working Group

